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IMPACTS OF GLOBAL AND REGIONAL CLIMATE ON WHOOPING CRANE DEMOGRAPHY: TRENDS AND EXTREME EVENTS

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Abstract: We analyzed long-term demographic and environmental data to understand the role of large scale climatic factors (the Pacific Decadal Oscillations [PDO]) and environmental factors in 3 regions of North America on natality and mortality of the remnant migratory whooping crane (*Grus americana*) population. This is an endangered species that spends winters at Aransas National Wildlife Refuge (ANWR) in Texas, breeds at Wood Buffalo National Park (WBNP) in Canada and "...uses Nebraska as a primary stopover". Long term data (27 years) of demography and environmental factors (PDO index, temperature and precipitation at WBNP, Nebraska and ANWR, pond water depth at WBNP, freshwater inflow, and net evaporation at wintering ground) were analyzed. Multiple regression analysis (path analysis) and qualitative analysis determined mechanisms (trends and extreme events) affecting whooping crane dynamics. Changes in mortality of eggs, chicks, juveniles during fall migration and at wintering grounds, and adults and subadults at wintering grounds, from April to November and annually, were correlated with environmental factors from the 3 different regions (except net evaporation at ANWR and temperature and precipitation in Nebraska during spring migration). Natality variability (brood failure and clutch size reduction) was explained by PDO, pond water depth in WBNP and environmental factors from the wintering ground that affected pre-breeding conditions and subsequently reproduction. Qualitative analysis showed synchrony of extreme events at ANWR and WBNP and extreme effects on whooping crane demography. Direct and indirect effects of these environmental factors are discussed at the population and individual level.

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Key words: Aransas-Wood Buffalo population, climate change, demography, *Grus americana*, Pacific decadal oscillation, whooping cranes.
